

**Amendments to the Claims:**

Following is a complete listing of the claims pending in the application, as amended:

1. (Currently Amended) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and, the invocation request identifying the attribute whose value is to be provided, the invocation request further specifying a basis for determining one of a plurality of values of the identified attribute that are available from different sources to provide such that a newest available value of the identified attribute is to be selected; and

in response to receiving the invocation request, providing a value for the identified attribute and an uncertainty level for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the newest available value of the identified attribute.

2. (Original) The method of claim 1 wherein the invocation request is a function call.

3. (Original) The method of claim 1 wherein the invocation request is a procedure.

4. (Original) The method of claim 1 wherein the invocation request is an invocation message.

5. (Original) The method of claim 1 wherein a value of the identified attribute is stored, and wherein the stored value is provided to the requesting attribute consumer.

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6. (Previously Presented) The method of claim 1 wherein the identified attribute is associated with an attribute source, and wherein the method further comprises obtaining a value of the identified attribute from the attribute source with which the identified attribute is associated, and wherein the value of the attribute obtained from the attribute source is provided to the requesting attribute consumer.

7. (Original) The method of claim 1 further comprising, in addition to providing a value for the identified attribute to the requesting attribute consumer, providing units of the value for the identified attribute.

8. (Canceled.)

9. (Original) The method of claim 1 further comprising, in addition to providing a value for the identified attribute to the requesting attribute consumer, providing a timestamp for the identified attribute.

10. (Original) The method of claim 1 wherein the identified attribute is information reflecting an aspect of the computing device.

11. (Original) The method of claim 10 wherein the computing device has a visual output device, and wherein the identified attribute is information about the availability of the visual output device.

12. (Original) The method of claim 1 wherein the computing device is present in an environment, and wherein the identified attribute is information reflecting an aspect of the environment.

13. (Currently Amended) ~~A—The method in a computing device for exchanging context attributes, comprising: receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, of claim 1~~

~~wherein the identified attribute being information reflecting an aspect a temperature of an environment in which the computing device is present, such that the environment has a temperature and the identified attribute is the temperature of the environment; and~~

~~in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer.~~

14. (Original) The method of claim 1 wherein the computing device has a user, and wherein the identified attribute is information reflecting an aspect of the user.

15. (Currently Amended) ~~A The method in a computing device for exchanging context attributes, comprising: receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, of claim 1 wherein the identified attribute being information reflecting an aspect a blood pressure of a user of the computing device, such that the user has a blood pressure and the identified attribute is the blood pressure of the user; and~~

~~in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer.~~

16. (Original) The method of claim 1 wherein one or more applications are executing on the computing device, and wherein the Identified attribute is information reflecting an aspect of an executing application.

17. (Original) The method of claim 16 wherein an electronic messaging application is among the applications executing on the computing device, and wherein the identified attribute indicates whether new messages have been received by the electronic messaging application.

18. (Original) The method of claim 1 wherein the computing device is outside a selected remote environment, and wherein the identified attribute is information reflecting an aspect of the remote environment.

19. (Currently Amended) ~~A The method in a computing device for exchanging context attributes, comprising: receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, of claim 1 wherein the identified attribute being information reflecting an aspect a temperature of a selected remote environment of which remote from the computing device, is outside such that the environment has a temperature and the identified attribute is the temperature of the remote environment; and~~

~~in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer.~~

20. (Original) The method of claim 1 wherein the computing device has a user, and wherein the identified attribute is information reflecting an aspect of a selected person other than the user.

21. (Original) The method of claim 20 wherein the selected person has a location, and wherein the identified attribute is the location of the selected person.

22. (Original) The method of claim 1 wherein the identified attribute is information reflecting an aspect of an identified person.

23. (Currently Amended) ~~A The method in a computing device for exchanging context attributes, comprising: receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, of claim 1 wherein the identified attribute being information reflecting an aspect a temperature of an~~

~~identified person, such that the identified person has a temperature and the identified attribute is the temperature of the identified person; and~~

~~in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer.~~

24. (Currently Amended) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and, ~~the invocation request identifying the an attribute whose value is to be provided, the identified attribute having a source such that a value of the identified attribute previously obtained from the source is cached with an indication of an age of the previously-obtained value; and further specifying a maximum age for the attribute value; and~~

in response to receiving the invocation request, providing to the requesting attribute consumer a value for the identified attribute by, ~~that has an age that is no older than the specified maximum age.~~

determining whether the age of the previously-obtained value of the identified attribute exceeds a specified maximum age;

if the age of the previously-obtained value of the identified attribute does not exceed the specified maximum age, providing the previously-obtained value of the identified attribute to the requesting attribute consumer; and

if the age of the previously-obtained value of the identified attribute does exceed the specified maximum age;

obtaining a new value of the identified attribute from the source of the identified attribute, and

providing the new value of the identified attribute to the requesting attribute consumer.

25. (Currently Amended) ~~A The method in a computing device for exchanging context attributes, comprising: receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute~~

~~consumer and identifying the attribute whose value is to be provided, the identified attribute having a source such that a value of the identified attribute previously obtained from the source is cached with an indication of an of claim 1 wherein the invocation request further specifies a maximum age of the previously obtained value of the identified attribute to be provided, and wherein the value provided to the requesting attribute consumer has an age that is no older than the specified maximum age. ; and~~

~~in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer by:~~

~~— determining whether the age of the previously obtained value of the identified attribute exceeds the specified maximum age;~~

~~— if the age of the previously obtained value of the identified attribute does not exceed the specified maximum age, providing the previously obtained value of the identified attribute to the requesting attribute consumer; and~~

~~— if the age of the previously obtained value of the identified attribute exceeds the specified maximum age:~~

~~— obtaining a new value of the identified attribute from the source of the identified attribute, and~~

~~— providing the new value of the identified attribute to the requesting attribute consumer.~~

26. (Currently Amended) The method of claim 25-24 further comprising caching the new value of the identified attribute.

27. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, the identified attribute having a source such that a value of the identified attribute previously obtained from the source is cached with an indication of the age of the previously-obtained value of the identified attribute; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer by,

determining whether the age of the previously-obtained value of the identified attribute exceeds the specified maximum age;

if the age of the previously-obtained value of the identified attribute does not exceed the specified maximum age, providing the previously-obtained value of the identified attribute to the requesting attribute consumer; and

if the age of the previously-obtained value of the identified attribute exceeds the specified maximum age:

obtaining a new value of the identified attribute from the source of the identified attribute,

determining that the new value of the identified attribute exceeds the specified maximum age, and

in response to determining that the new value of the identified attribute exceeds the specified maximum age, generating an error condition indicating that the source is unable to satisfy the specified maximum age.

28. (Original) The method of claim 1 wherein a value of the identified attribute is available from each of a plurality of sources, and wherein the invocation request further specifies one of the plurality of sources from which a value of the identified attribute is available, and wherein the value of the identified attribute provided to the requesting attribute consumer is from the specified source.

29. (Original) The method of claim 1 wherein a value of the identified attribute is available from each of a plurality of sources, and wherein the invocation request further specifies to provide a value of the identified attribute from each of the sources from which a value of the identified attribute is available, and wherein a value of the identified attribute from each of the sources from which a value of the identified attribute is available is provided to the requesting attribute consumer.

30. (Original) The method of claim 1 wherein a value of the identified attribute is available from each of a plurality of sources, and wherein the value of the identified attribute provided to the requesting attribute consumer is determined based upon the values of the identified attribute available from the plurality of sources.

31. (Original) The method of claim 30, further comprising caching the value of the identified attribute provided to the requesting attribute consumer.

32. (Original) The method of claim 1 wherein a plurality of values of the identified attribute are available from different sources, and wherein the invocation request further specifies to select one of the plurality of available values of the identified attribute to provide, and wherein the value of the identified attribute provided to the requesting attribute consumer is selected from the plurality of available values of the identified attribute.

33. (Original) The method of claim 1 wherein a plurality of values of the identified attribute are available from different sources, and wherein the invocation request further specifies to determine a value of the identified attribute to provide that is based upon the plurality of available values of the identified attribute but different than each of the plurality of available values of the identified attribute, and wherein the value of the identified attribute provided to the requesting attribute consumer is based upon the plurality of available values of the identified attribute but different from each of the plurality of available values of the identified attribute.

34. (Original) The method of claim 1 wherein a plurality of values of the identified attribute are available from different sources, and wherein the invocation request further specifies to determine, from the plurality of available values of the identified attribute, one value of the identified attribute to provide, and wherein the value of the identified attribute provided to the requesting attribute consumer is determined from the plurality of available values of the identified attribute.



35. (Original) The method of claim 34 wherein the invocation request further specifies a basis for determining, from the plurality of available values of the identified attribute, one value of the identified attribute to provide, and wherein the value of the identified attribute provided to the requesting attribute consumer is determined from the plurality of available values of the identified attribute using the specified basis.

36. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an Invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, the invocation request further specifying a basis for determining one of a plurality of values of the identified attribute that are available from different sources to provide such that the oldest available value of the identified attribute is to be selected; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the oldest available value of the identified attribute.

37. (Currently Amended) ~~A The method in a computing device for exchanging context attributes, comprising: of claim 1 further comprising, in addition to providing a value for the identified attribute to the requesting attribute consumer, providing an uncertainty level for the identified attribute.~~

~~receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, the invocation request further specifying a basis for determining one of a plurality of values of the identified attribute that are available from different sources to provide such that the newest available value of the identified attribute is to be selected; and~~

~~in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the~~

~~plurality of available values of the identified attribute using the specified basis such that the provided value is the newest available value of the identified attribute.~~

38. (Original) The method of claim 35 wherein the available values of the identified attribute are each requested and received from a different source, and wherein the invocation request further specifies selecting the first-received available value of the identified attribute, and wherein the value of the identified attribute provided to the requesting attribute consumer is the first-received available value of the identified attribute.

39. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, the invocation request further specifying a basis for determining one of a plurality of values of the identified attribute that are available from different sources to provide such that the available value of the identified attribute having a lowest uncertainty level is to be selected; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the available value of the identified attribute having the lowest uncertainty level.

40. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, the invocation request further specifying a basis for determining a value of the identified attribute to provide that is an average of a plurality of values of the identified attribute that are available from different sources; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the average of the available values of the identified attribute.

41. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, each of a plurality of values of the identified attribute that are available from different sources having an uncertainty level, the invocation request further specifying a basis for determining a value of the identified attribute to provide based at least in part on uncertainty level; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the average of the available values of the identified attribute, weighted by their uncertainty levels.

42. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, each of a plurality of values of the identified attribute that are available from different sources having an age, the invocation request further specifying a basis for determining a value of the identified attribute to provide based at least in part on age; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that

the provided value is the average of the available values of the identified attribute, weighted by their ages.

43. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, the invocation request further specifying a basis for determining one of a plurality of values of the identified attribute that are available from different sources to provide such that the available value of the identified attribute that occurs the largest number of times among the available values of the identified attribute is to be selected; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the available value of the identified attribute that occurs the largest number of times among the available values of the identified attribute.

44. (Original) The method of claim 35 wherein the invocation request further specifies soliciting selection by a user of one of the available values of the identified attribute, and wherein the value of the identified attribute provided to the requesting attribute consumer is an available value of the identified attribute selected by the user.

45. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and identifying the attribute whose value is to be provided, each of a plurality of values of the identified attribute that are available from different sources having an uncertainty level and an effective time, the invocation request further specifying a basis for selecting an available value of the

identified attribute based upon a function of the uncertainty level and effective time of each; and

in response to receiving the invocation request, providing a value for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is selected from the available values of the identified attribute based upon the function of the uncertainty level and effective time of each.

46. (Original) The method of claim 1 wherein the invocation request is received by a context characterization module, and wherein the context characterization module has an attribute under its control, and wherein the invocation request identifies the attribute under the control of the characterization module, and wherein the attribute whose value is provided to the requesting attribute consumer is the attribute under the control of the characterization module.

47. (Original) The method of claim 1 further comprising, before the invocation request to provide an attribute value is received, receiving from the attribute consumer an invocation request to register the attribute consumer.

48. (Original) The method of claim 47 wherein the invocation request to register an attribute consumer indicates that the requesting attribute consumer reserves an opportunity to later request provision of a value of the identified attribute, the method further comprising associating with the identified attribute an indication that the requesting attribute consumer is dependent on the identified attribute.

49. (Original) The method of claim 1 further comprising, before the invocation request to provide an attribute value is received, receiving an invocation request to register an attribute source for the identified attribute, and wherein the method further comprises obtaining a value of the identified attribute from the attribute source with which the identified attribute is associated, and wherein the value of the attribute

obtained from the attribute source with which the identified attribute is provided to the requesting attribute consumer.

50. (Currently Amended) A computing device for exchanging context attributes, comprising:

an invocation request receiver that receives an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer and, the invocation request identifying the attribute whose value is to be provided and specifying a basis for determining one of a plurality of values of the identified attribute that are available from different sources such that a newest available value of the identified attribute is to be selected; and

an attribute value provider that provides a value for the identified attribute ~~and an uncertainty level for the identified attribute~~ to the requesting attribute consumer in response to receipt of the invocation request by the invocation request receiver, the value provided being determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the newest available value of the identified attribute.

51. (Original) The computing device of claim 50 wherein the computing device is a mobile computing device.

52. (Original) The computing device of claim 50 wherein the computing device is a wearable computing device worn on the body of a human user.

53. (Original) The computing device of claim 50 further comprising an attribute value memory that contains a value of the identified attribute, wherein the attribute value contained in the attribute value memory is provided to the requesting attribute consumer by the attribute value provider.

54. (Original) The computing device of claim 50 wherein the identified attribute is associated with an attribute source, the computing device further comprising

an attribute procurement subsystem that obtains a value of the identified attribute from the attribute source with which the identified attribute is associated, and wherein the value of the attribute obtained from the attribute source with which the identified attribute is provided to the requesting attribute consumer by the attribute value provider.

55. (Previously Presented) A computing device for exchanging context attributes, comprising:

an invocation request receiver that receives an invocation request to provide an attribute value, the invocation request being generated by a requesting attribute consumer, the invocation request identifying the attribute whose value is to be provided, the identified attribute having a source and a value of the identified attribute previously obtained from the source being cached with an indication of the age of the previously-obtained value of the identified attribute;

an age determination subsystem that determines whether the age of the previously-obtained value of the identified attribute exceeds a specified maximum age in response to receipt of the invocation request by the invocation request receiver; and

an attribute value provider that provides a value for the identified attribute to the requesting attribute consumer in response to receipt of the invocation request by the invocation request receiver in such a manner that the previously-obtained value of the identified attribute is provided if its age does not exceed the specified maximum age and in such a manner that a new value of the identified attribute that is obtained from the source is provided if the age of the previously-obtained value of the identified attribute exceeds the specified maximum age.

56. (Original) The computing device of claim 50 wherein a value of the identified attribute is available from each of a plurality of sources, and wherein the invocation request further specifies one of the plurality of sources from which a value of the identified attribute is available, and wherein the value of the identified attribute provided to the requesting attribute consumer by the attribute value provider is from the specified source.

57. (Original) The computing device of claim 50 wherein a value of the identified attribute is available from each of a plurality of sources, and wherein the invocation request further specifies to provide a value of the identified attribute from each of the sources from which a value of the identified attribute is available, and wherein a value of the identified attribute from each of the sources from which a value of the identified attribute is available is provided to the requesting attribute consumer by the attribute value provider.

58. (Original) The computing device of claim 50 wherein a value of the identified attribute is available from each of a plurality of sources, and wherein the value of the identified attribute provided to the requesting attribute consumer is determined based upon the plurality of values of the identified attribute available from different sources.

59. (Original) The computing device of claim 50 wherein a plurality of values of the identified attribute are available from different sources, and wherein the value of the identified attribute provided to the requesting attribute consumer by the attribute value provider is selected from the plurality of available values of the identified attribute.

60. (Original) The computing device of claim 50 wherein a plurality of values of the identified attribute are available from different sources, and wherein the value of the identified attribute provided to the requesting attribute consumer by the attribute value provider is based upon the plurality of available values of the identified attribute but different from each of the plurality of available values of the identified attribute.

61. (Currently Amended) A computer-readable medium whose contents cause a computing device to exchange context attributes, by performing a method comprising:

receiving an invocation request to provide an attribute value, the invocation request ~~being generated by from a requesting attribute consumer, the invocation request identifying the attribute whose value is to be provided and specifying a basis for~~



determining one of a plurality of values of an identified attribute that are available from different sources such that a newest available value of the identified attribute is to be selected; and

In response to receiving the invocation request, providing a value for the identified attribute and an uncertainty level for the identified attribute to the requesting attribute consumer that is determined from the plurality of available values of the identified attribute using the specified basis such that the provided value is the newest available value of the identified attribute.

62-72. (Canceled.)

73. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to register an attribute, the invocation request being generated by an attribute source, the invocation request identifying the attribute to be registered and further specifying a manner of invoking the attribute source to obtain the identified attribute from the attribute source;

in response to receiving the invocation request, generating an indication that the identified attribute can be obtained from the attribute source, the generated indication including an indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source;

invoking the attribute source in the specified manner to obtain the identified attribute from the attribute source; and

in response to invocation of the attribute source, receiving the identified attribute from the attribute source so as to receive a value of the attribute and an indication of the time at which the value of the attribute is most accurate.

74. (Canceled.)

75. (Canceled.)

76. (Previously Presented) The method of claim 73 wherein invoking the attribute source to obtain the identified attribute from the attribute source includes an identification of the attribute.

77. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to register an attribute, the invocation request being generated by an attribute source, the invocation request identifying the attribute to be registered and further specifying a manner of invoking the attribute source to obtain the identified attribute from the attribute source;

in response to receiving the invocation request, generating an indication that the identified attribute can be obtained from the attribute source, the generated indication including an indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source; and

invoking the attribute source in the specified manner to obtain the identified attribute from the attribute source, wherein the invoking includes an indication of a maximum time in which the attribute source is expected to supply the identified attribute.

78. (Canceled.)

79. (Canceled.)

80. (Currently Amended) ~~A The method in a computing device for exchanging context attributes, comprising:~~

~~receiving an invocation request to register an attribute, the invocation request being generated by an attribute source, the invocation request identifying the attribute~~

~~to be registered and further specifying a manner of invoking the attribute source to obtain the identified attribute from the attribute source;~~

~~in response to receiving the invocation request, generating an indication that the identified attribute can be obtained from the attribute source, the generated indication including an indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source; and~~

~~invoking the attribute source in the specified manner to obtain the identified attribute from the attribute source;~~

~~in response to invocation of the attribute source, of claim 73 wherein the receiving of the identified attribute from the attribute source so as to receive a value of the attribute and includes receiving an indication of the a level of uncertainty of the value of the attribute.~~

81. (Canceled.)

82. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to register an attribute, the invocation request being generated by an attribute source, the invocation request identifying the attribute to be registered and further specifying a manner of invoking the attribute source to obtain the identified attribute from the attribute source;

in response to receiving the invocation request, generating an indication that the identified attribute can be obtained from the attribute source, the generated indication including an indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source; and

invoking the attribute source in the specified manner to obtain the identified attribute from the attribute source;

in response to invocation of the attribute source, receiving the identified attribute from the attribute source so as to receive a value of the attribute and an indication of units in which the value of the attribute is expressed.

83. (Previously Presented) A method in a computing device for exchanging context attributes, comprising:

receiving an invocation request to register an attribute, the invocation request being generated by an attribute source, the invocation request identifying the attribute to be registered and further specifying a manner of invoking the attribute source to obtain the identified attribute from the attribute source;

in response to receiving the invocation request, generating an indication that the identified attribute can be obtained from the attribute source, the generated indication including an indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source; and

invoking the attribute source in the specified manner to obtain the identified attribute from the attribute source;

in response to invocation of the attribute source, receiving the identified attribute from the attribute source so as to receive a value of the attribute and an indication of a format in which the value of the attribute is expressed.

84. (Previously Presented) The method of claim 73 further comprising:

receiving an invocation request to provide an attribute value, the invocation request to provide an attribute value identifying the attribute identified by the invocation request to register an attribute, the invocation request to provide an attribute value being generated by a requesting attribute consumer; and

in response to receiving the invocation request to provide an attribute value:

using the generated indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source to invoke the attribute source to obtain the identified attribute from the attribute source, and

providing the attribute value obtained from the attribute source to the requesting attribute consumer.

85. (Original) The method of claim 73, wherein the invocation request further specifies a name of the attribute, and wherein the generated indication that the

Identified attribute can be obtained from the attribute source includes an indication of the specified name of the attribute.

86. (Original) The method of claim 73, wherein the invocation request further specifies a name of the attribute source, and wherein the generated indication that the identified attribute can be obtained from the attribute source includes an indication of the specified name of the attribute source.

87. (Original) The method of claim 73, wherein the invocation request further specifies a data type of the attribute, and wherein the generated indication that the identified attribute can be obtained from the attribute source includes an indication of the specified data type of the attribute.

88. (Original) The method of claim 73, wherein the invocation request further specifies an indication of a format of the attribute, and wherein the generated indication that the identified attribute can be obtained from the attribute source includes an indication of the specified format indication of the attribute.

89. (Previously Presented) A computer-readable medium whose contents cause a computing device to exchange context attributes, by performing a method comprising:

receiving an invocation request to register an attribute, the invocation request being generated by an attribute source, the invocation request identifying the attribute to be registered and further specifying a manner of invoking the attribute source to obtain the identified attribute from the attribute source;

in response to receiving the invocation request, generating an indication that the identified attribute can be obtained from the attribute source, the generated indication including an indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source;

invoking the attribute source in the specified manner to obtain the identified attribute from the attribute source; and

In response to invocation of the attribute source, receiving the identified attribute from the attribute source so as to receive a value of the attribute and an indication of the time at which the value of the attribute is most accurate.

90. (Canceled.)

91. (Canceled.)

92. (Previously Presented) The computer-readable medium of claim 89 wherein invoking the attribute source to obtain the identified attribute from the attribute source includes an identification of the attribute.

93. (Previously Presented) The computer-readable medium of claim 89 wherein the contents of the computer-readable medium further cause the computing device to:

receive an invocation request to provide an attribute value, the invocation request to provide an attribute value identifying the attribute identified by the invocation request to register an attribute, the invocation request to provide an attribute value being generated by a requesting attribute consumer; and

in response to receiving the invocation request to provide an attribute value:

using the generated indication of the specified manner of invoking the attribute source to obtain the identified attribute from the attribute source to invoke the attribute source to obtain the identified attribute from the attribute source, and

providing the attribute value obtained from the attribute source to the requesting attribute consumer.

94-123. (Canceled.)

124. (Original) The method of claim 1, further comprising the step of, in response to receiving the invocation request, providing a name and a value of a property associated with the identified attribute to the requesting attribute consumer.

125. (Original) The method of claim 6, further comprising obtaining a value of a property associated with the identified attribute from the attribute source with which the identified attribute is associated.

126. (Original) The method of claim 125, further comprising providing the obtained associated property value to the requesting attribute consumer.

127. (Original) The method of claim 125, wherein the obtained property is security information associated with the identified attribute, further comprising using the security information to determine whether to provide a value for the identified attribute to the requesting attribute consumer.

128-130. (Canceled.)

131. (Previously Presented) The method of claim 24 wherein the invocation request is a function call.

132. (Previously Presented) The method of claim 24 wherein the invocation request is a procedure.

133. (Previously Presented) The method of claim 24 wherein the invocation request is an invocation message.

134. (Previously Presented) The method of claim 24 wherein a value of the identified attribute is stored, and wherein the provided value is the stored value.

135. (Previously Presented) The method of claim 24 wherein the identified attribute is associated with an attribute source, and wherein the method further comprises obtaining a value of the identified attribute from that attribute source, and wherein the provided value is the obtained value from the attribute source.

136. (Previously Presented) The method of claim 24 further comprising, in addition to providing a value for the identified attribute to the requesting attribute consumer, providing units of the value for the identified attribute.

137. (Previously Presented) The method of claim 24 further comprising, in addition to providing a value for the identified attribute to the requesting attribute consumer, providing a timestamp for the identified attribute.

138. (Previously Presented) The method of claim 24 wherein the identified attribute reflects an aspect of the computing device.

139. (Previously Presented) The method of claim 138 wherein the computing device has a visual output device, and wherein the identified attribute reflects availability of the visual output device.

140. (Previously Presented) The method of claim 24 wherein the computing device is present in an environment, and wherein the identified attribute reflects an aspect of the environment.

141. (Previously Presented) The method of claim 24 wherein the computing device has a user, and wherein the identified attribute reflects an aspect of the user.

142. (Previously Presented) The method of claim 24 wherein one or more applications are executing on the computing device, and wherein the identified attribute reflects an aspect of an executing application.

143. (Previously Presented) The method of claim 142 wherein an electronic messaging application is among the applications executing on the computing device, and wherein the identified attribute indicates whether new messages have been received by the electronic messaging application.



144. (Previously Presented) The method of claim 24 wherein the computing device is outside a specified remote environment, and wherein the identified attribute reflects an aspect of the remote environment.

145. (Previously Presented) The method of claim 24 wherein the computing device has a user, and wherein the identified attribute reflects an aspect of a specified person other than the user.

146. (Previously Presented) The method of claim 145 wherein the specified person has a location, and wherein the identified attribute is the location of the specified person.

147. (Previously Presented) The method of claim 24 wherein the identified attribute reflects an aspect of an identified person.

148. (Previously Presented) The method of claim 24 wherein values for the identified attribute are available from each of a plurality of sources, wherein the invocation request further specifies one of those sources, and wherein the provided value is from the specified source.

149. (Previously Presented) The method of claim 24 wherein values for the identified attribute are available from each of a plurality of sources, wherein the invocation request further specifies to provide a value of the identified attribute from each of the sources from which a value of the identified attribute is available, and wherein the providing of the value to the requesting attribute consumer further includes providing to the requesting attribute consumer a value of the identified attribute from each of the sources from which a value of the identified attribute is available.

150. (Previously Presented) The method of claim 24 wherein values for the identified attribute are available from each of a plurality of sources, and wherein the value of the identified attribute that is provided to the requesting attribute consumer is

determined based upon the values of the identified attribute available from the plurality of sources.

151. (Previously Presented) The method of claim 150, further comprising caching the value of the identified attribute provided to the requesting attribute consumer.

152. (Previously Presented) The method of claim 24 wherein a plurality of values of the identified attribute are available from different sources, and wherein the invocation request further specifies to select one of the plurality of available values of the identified attribute to provide, and wherein the value of the identified attribute provided to the requesting attribute consumer is selected from the plurality of available values of the identified attribute.

153. (Previously Presented) The method of claim 24 wherein a plurality of values of the identified attribute are available from different sources, and wherein the invocation request further specifies to determine a value of the identified attribute to provide that is based upon the plurality of available values of the identified attribute but different than each of the plurality of available values of the identified attribute, and wherein the value of the identified attribute provided to the requesting attribute consumer is based upon the plurality of available values of the identified attribute but different from each of the plurality of available values of the identified attribute.

154. (Previously Presented) The method of claim 24 wherein a plurality of values of the identified attribute are available from different sources, and wherein the invocation request further specifies to determine one value from the plurality of available values of the identified attribute to provide, and wherein the value of the identified attribute provided to the requesting attribute consumer is determined from the plurality of available values of the identified attribute.

155. (Previously Presented) The method of claim 154 wherein the invocation request further specifies a basis for determining one value from the plurality of available values of the identified attribute to provide, and wherein the value of the identified attribute provided to the requesting attribute consumer is determined from the plurality of available values of the identified attribute using the specified basis.

156. (Previously Presented) The method of claim 155 wherein the available values of the identified attribute are each requested and received from a different source, and wherein the invocation request further specifies selecting the first-received available value of the identified attribute, and wherein the value of the identified attribute provided to the requesting attribute consumer is the first-received available value of the identified attribute.

157. (Previously Presented) The method of claim 155 wherein the invocation request further specifies soliciting selection by a user of one of the available values of the identified attribute, and wherein the value of the identified attribute provided to the requesting attribute consumer is an available value of the identified attribute selected by the user.

158. (Previously Presented) The method of claim 24 wherein the invocation request is received by a context characterization module that has an attribute under its control, wherein the invocation request identifies the attribute under the control of the characterization module, and wherein the attribute whose value is provided to the requesting attribute consumer is the attribute under the control of the characterization module.

159. (Previously Presented) The method of claim 24 further comprising, before the invocation request to provide an attribute value is received, receiving from the attribute consumer an invocation request to register the attribute consumer.

160. (Previously Presented) The method of claim 159 wherein the invocation request to register an attribute consumer indicates that the requesting attribute consumer reserves an opportunity to later request provision of a value of the identified attribute, the method further comprising associating with the identified attribute an indication that the requesting attribute consumer is dependent on the identified attribute.

161. (Previously Presented) The method of claim 24 further comprising, before the invocation request to provide an attribute value is received, receiving an invocation request to register an attribute source for the identified attribute, and wherein the method further comprises obtaining a value of the identified attribute from the attribute source with which the identified attribute is associated, and wherein the value of the attribute obtained from the attribute source with which the identified attribute is provided to the requesting attribute consumer.

162. (Previously Presented) The method of claim 24 wherein the specified maximum age is older than the ages of any values for the identified attribute.

163. (Previously Presented) The method of claim 24 wherein the specified maximum age is an indication that any age is acceptable.

164. (Previously Presented) The method of claim 24 wherein the specification of the maximum age in the invocation request is a lack of an indication of an explicit maximum age, and wherein determining whether a value for the identified attribute has an age that is no older than the specified maximum age includes determining that any attribute value age is no older than the specified maximum age.

165. (Previously Presented) The method of claim 24 wherein the specification of the maximum age in the invocation request is a lack of an indication of an explicit maximum age, and wherein determining whether a value for the identified attribute has

an age that is no older than the specified maximum age includes determining that any attribute value age is older than the specified maximum age.

166. (Previously Presented) The method of claim 24 wherein the specification of the maximum age in the invocation request is a lack of an indication of an explicit maximum age, and wherein determining whether a value for the identified attribute has an age that is no older than the specified maximum age is performed in a manner unknown to the requesting attribute consumer.

167. (Previously Presented) The method of claim 24 wherein the specification of the maximum age in the invocation request is optional, and wherein determining whether a value for the identified attribute has an age that is no older than the specified maximum age when an explicit maximum age is not specified in the invocation request includes determining whether the attribute value age is no older than a default maximum age.

168. (Previously Presented) The method of claim 167 wherein the default maximum age is specified by the requesting attribute consumer.

169. (Previously Presented) The method of claim 167 wherein the default maximum age is a system default.

170. (Previously Presented) The method of claim 167 wherein the default maximum age is a default provided by a source for the provided attribute value.

171. (Previously Presented) The method of claim 167 wherein the default maximum age is obtained externally.

172. (Previously Presented) The method of claim 167 wherein the default maximum age is functionally determined based at least in part on a current context of the computing device.

173. (Previously Presented) The method of claim 167 wherein the method is performed by a characterization module executing on the computing device, and wherein the default maximum age is functionally determined based at least in part on a current context of the characterization module.

174. (Previously Presented) The method of claim 167 wherein the default maximum age is functionally determined based at least in part on a current context of the requesting attribute consumer.

175. (Previously Presented) The method of claim 167 wherein the default maximum age is functionally determined based at least in part on values of one or more derived attributes related to the identified attribute.

176. (Previously Presented) The method of claim 167 wherein each attribute has a distinct default maximum age.

177. (Previously Presented) The method of claim 176 wherein the default maximum ages for the attributes are stored in a table that is regularly updated.

178. (Previously Presented) The method of claim 176 wherein the default maximum ages for the attributes are stored in a table that is dynamically updated.

179. (Previously Presented) The method of claim 167 wherein the default maximum age is learned.

180. (Previously Presented) The method of claim 179 wherein the learning is performed based on specifications for maximum age from previous requests.

181. (Previously Presented) The method of claim 179 wherein the learning is performed based on monitoring values for the identified attribute over time.

182. (Previously Presented) The method of claim 179 wherein the learning is performed based on monitoring whether an earlier value for the default maximum age was later found to be appropriate.

183. (Previously Presented) The method of claim 24 wherein the specification of the maximum age includes one or more criteria for determining the maximum age in a manner based upon the provided attribute value.

184. (Previously Presented) The method of claim 24 wherein the maximum age is determined from a timestamp.

185. (Previously Presented) The method of claim 24 wherein the maximum age is determined relative to a time when the request was made.

186. (Previously Presented) The method of claim 24 wherein the maximum age is determined relative to a time when the request was received.

187. (Previously Presented) The method of claim 24 wherein the maximum age is determined relative to a time when a value for the identified attribute was last supplied.

188. (Previously Presented) The method of claim 24 wherein the maximum age is determined relative to a time when a value for the identified attribute was last generated.

189. (Previously Presented) The method of claim 24 wherein the maximum age is based on an absolute time.

190. (Previously Presented) The method of claim 24 wherein the maximum age is determined relative to a time when the provided attribute value was valid.

191. (Previously Presented) The method of claim 24 including, before the providing of the value to the attribute consumer, receiving from a source the provided value for the identified attribute and information regarding when the provided attribute value is valid.

192. (Previously Presented) The method of claim 24 wherein the providing of the identified attribute value includes providing information regarding when the provided attribute value is valid.

193. (Previously Presented) The method of claim 24 wherein the maximum age is based on when a source for values of the identified attribute was last checked.

194. (Previously Presented) The method of claim 24 wherein the maximum age is based on when a source for values of the identified attribute was valid.

195. (Previously Presented) The method of claim 24 wherein the maximum age is based on when values of the identified attribute were last obtained from a source.

196. (Previously Presented) The method of claim 24 wherein the maximum age is based on an expiration time for the provided attribute value.

197. (Previously Presented) The method of claim 24 wherein the maximum age is based on a specific time supplied by the requesting attribute consumer.

198. (Previously Presented) The method of claim 24 wherein the maximum age is represented as a range of ages that are acceptable for an attribute value to be provided.

199. (Previously Presented) The method of claim 24 wherein the maximum age is represented as a range of ages that are not acceptable for an attribute value to be provided.



200. (Previously Presented) The method of claim 24 wherein the maximum age is represented as multiple ages.

201. (Previously Presented) The method of claim 24 including providing a mechanism to functionally determine the maximum age.

202. (Previously Presented) The method of claim 24 wherein the provided attribute value is derived from information provided by multiple sources, and including determining the age for the provided attribute value.

203. (Previously Presented) The method of claim 24 wherein the specified maximum age includes indications of multiple criteria.

204. (Previously Presented) The method of claim 24 wherein the specified maximum age includes criteria for determining the maximum age that vary based on a source of the provided value for the identified attribute.

205. (Previously Presented) The method of claim 24 including, before the providing of the identified attribute value, determining the value of the identified attribute to be provided, the determining performed in such a manner as to only use attribute values whose age is less than the specified maximum age.

206. (Previously Presented) The method of claim 24 including, in response to the specified maximum age, generating a new value for the identified attribute to be used as the provided value.

207. (Previously Presented) The method of claim 24 wherein the providing of the identified attribute value further includes providing one or more indications of information used to generate the provided attribute value.

208. (Previously Presented) The method of claim 207 wherein the provided indications of the information used to generate the provided attribute value include ages of one or more pieces of the information.

209. (Previously Presented) The method of claim 24 wherein the provided identified attribute value has an uncertainty that is based at least in part on the age of the value.

210. (Previously Presented) The method of claim 209 wherein the uncertainty of the value based on the age is determined based upon a table.

211. (Previously Presented) The method of claim 209 wherein the uncertainty of the value based on the age is determined based upon a functional relationship.

212. (Previously Presented) The method of claim 209 wherein the uncertainty of the value based on the age is determined based upon historical data.

213. (Previously Presented) The method of claim 209 wherein the uncertainty of the value based on the age is determined based upon a defined mechanism.

214. (Previously Presented) The method of claim 213 wherein the defined mechanism is received from the requesting attribute consumer.

215. (Previously Presented) The method of claim 213 wherein the method is performed by a characterization module executing on the computing device, and wherein the defined mechanism is provided by the characterization module.

216. (Previously Presented) The method of claim 24 wherein the providing of the identified attribute value further includes providing information as to how the maximum age was determined.

217. (Currently Amended) A computer-readable medium whose contents cause a computing device to exchange context attributes, by performing a method comprising:

receiving an invocation request from an attribute consumer to provide one or more values of an identified attribute, the identified attribute having a source such that one or more previously obtained values of the identified attribute from the source each have an associated age, the invocation request specifying a maximum age for at least one of the attribute values to be provided; and

in response, providing to the attribute consumer at least one value for the identified attribute by, whose age is no older than the specified maximum age;

determining whether the age of a previously-obtained value of the identified attribute exceeds a specified maximum age;

if the age of the previously-obtained value of the identified attribute does not exceed the specified maximum age, providing the previously-obtained value of the identified attribute to the attribute consumer; and

if the age of the previously-obtained value of the identified attribute does exceed the specified maximum age;

obtaining a new value of the identified attribute from the source of the identified attribute, and

providing the new value of the identified attribute to the attribute consumer.

218. (Currently Amended) ~~The computing device-computer-readable medium~~ of claim 217 wherein the contents are instructions that when executed cause the computing device to perform the method.

219. (Currently Amended) A computing device for exchanging context attributes, comprising:

an invocation request receiver configured to receive an invocation request from an attribute consumer to provide one or more values of an identified attribute, the invocation request identifying an attribute having a source such that one or more values

of the identified attribute from the source each have an associated age; specifying a maximum age for at least one of the attribute values to be provided; and

an attribute value provider configured to provide to the attribute consumer in response at least one value for the identified attribute by whose age is no older than the specified maximum age.

determining whether the age of a previously-obtained value of the identified attribute exceeds a specified maximum age;

if the age of the previously-obtained value of the identified attribute does not exceed the specified maximum age, providing the previously-obtained value of the identified attribute to the attribute consumer; and

if the age of the previously-obtained value of the identified attribute does exceed the specified maximum age;

obtaining a new value of the identified attribute from the source of the identified attribute, and

providing the new value of the identified attribute to the attribute consumer.

220. (Previously Presented) The computing device of claim 219 wherein the invocation request receiver and the attribute value provider are part of a characterization module executing in memory of the computing device.

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